Chapter III: Geographical and Environmental Setting of the Research area

A complete understanding of the geographical backdrop is required to comprehend an area's entire cultural evolution. The following sections therefore address the general physical characteristics of the research area.

III.1 Geographic Location of Jammu

The erstwhile state of Jammu and Kashmir comprised of the divisions of Jammu, Kashmir and Ladakh, which were three different physiographic entities combined to form a single unit in the year 1846 CE (Charak, 1985). Now designated as two separate Union Territories of Jammu and Kashmir, and Ladakh (Ministry of Law and Justice, 2019), these represent the northern most extension of India. The region consists of huge mountain masses interspersed by longitudinal valleys. In the whole region, there are four larger mountain ranges – the Karakoram, the Ladakh, the main Himalaya or Zanskar, and the Pir Panjal. Between these ranges, are the longitudinal valleys of the Gilgit, the Shyok, the Indus and the Jhelum. South of the Pir Panchal is the Siwalik range comparatively much lower in elevation and known as the Jammu Hills; further south there is a narrow strip of foothill plains (300 m), 25 km wide, merging into the Punjab plains (Singh, 2016:353). Metaphorically compared to a 'house with many storeys' (Lawrence, 1909: 1), Jammu is the opening compared to door facing south looking out the Punjab districts of Jhelum, Gujarat, Sialkot (all the areas in present day Pakistan) and Gurdaspur (India) (Fig. III. 1)

Figure III.1: General map - Jammu Kashmir and Ladakh and the adjoining territories

The district of Jammu is situated in the sub-mountainous region and at the foothills of the Himalayas. The northern and the north-western areas form a part of the Himalayan foothills with a number of low lying ridges, strike and transverse valleys. The hills gradually merge into the plains, where topography is gently undulating and flat. The mean sea level increases from 325 meters at Jammu to 1207 meters at Kalidhar near Chauki Chaura (Akhnoor) (Census of India [COI], 2011).

The district is located between 74°-24" and 75°-18" east longitude and 32°-50"and 33°-30" north latitude. It is bounded in the north by Riasi district, in the north-east by Udhampur district, in the east and south-east partly by Tehsil Ramnagar of Udhampur district and Samba district, in south and south-west

by Gurdaspur and Sialkot district of Rawalpindi (Pakistan), and in the north-west by tehsil Nowshehra of district Rajauri and parts of tehsil Bimber now under the occupation of Pakistan. Jammu District is divided into four Tehsils – Jammu, R.S Pura, Akhnoor and Bishnah (COI, 2011).

The research area mainly consists of two Tehsils – R.S Pura and Akhnoor. The Tehsil of Jammu, mainly owing to the present urbanised landscape, lacks an ancient settlement. The Tehsil of Bishnah, on the other hand, could not be thoroughly explored due to the limitation of time.

III.2 Physiography of Jammu District

The district has been divided into four sub-micro regions based on geo-physical conditions (COI, 2011) (Fig. III.2):

III.2.1 Jammu Siwalik West

Located in the north-western corner of the district, this zone forms a part of the slopes of the Siwalik range which is in the north of the district. Comprising of the lower hills of the Siwalik, locally known as Kalidhar mountains, they separate the district of Jammu from Rajauri. The routes leading to Rajauri and Poonch districts passes through the Kalidhar mountains. The zone is dissected by many small rivers and *nallas* essentially because of its irregular and uneven topography. The average height of the region is around 608 meters with the Kalidhar peak rising as high as 1024 meters. The area is full of pine trees, shisham and a variety of shrubs. The main rivers of the zone are the Chenab and the Munawar Tawi. Because of the undulating topography of the zone, the accessibility becomes a problem (COI, 2011).

III.2.2 Chenab–Tawi Plains

This sub-micro region is situated around two main rivers, the Chenab and the Tawi. Spread over the south-western and middle parts of the district, the region occupies a large part of Tehsil Jammu, areas of Akhnoor and Ranbirsingh Pura. The zone – in the south, south-west and west – shares the international boundary with Pakistan. District Udhampur lies in the north, near the area of entry of Chenab in the district. The north-eastern side of the zone is undulating with an average height of 750 meters, and on the south-western side lie the plains which are fertile due to the accumulative action of rivers bringing down the alluvium down into the plains. The important rivers flowing in the region are the Chenab, the Tawi and the Munawar Tawi along with a few streams that become active during the rainy season (COI, 2011).

III.2.3 Jammu Siwalik East

The region comprises of the hilly range running in the northern part of the district. It is spread over the upper north-eastern parts of the district, with an average height of about 600 meters. Descending southwards, they gradually merge with the plains, forming a sub-montane belt. The seasonal torrents/streams *(khads)* which are large in number in this zone, flow down the slopes of Siwalik and bring with the slit, gravel, boulders etc which they spread in plains. The main rivers of the region are the Tawi Basantar and the Devak, besides a number of small and large perennial and non-perennial streams and rivulets originating from the Siwalik. Forests are spread over a large part of the region, leaving a few patches mostly on the banks of rivers/streams for cultivation. The accessibility to this region is a problem especially in the rainy season (COI, 2011).

III.2.4 Jammu Foothill Plains

The sub-micro region is situated in the southernmost part of the district. On the west and south, the region shares the international boundary with Pakistan and on the south-eastern side it shares the border with the District of Samba. On the north-western side is located the zone of Chenab-Tawi plains, whereas on the north-eastern side lie the Jammu Siwalik East Zone. The zone is spread over a major part of tehsil Ranbirsinghpora, whole of Bishnah, south-western part of Samba tehsil of Samba district and south-eastern parts of Jammu. The average height of the area does not exceed beyond 500 meters. The area owing to its fertility supports rich cultivation. There are no forests in the region, but the growth of shrubs and scrubs is dense. The main rivers of sub-micro region are the Basantar river and Aik-*nalla* which along with many tributaries spread sand, gravel, loamy soil, and boulders in the plain areas of the region (COI, 2011).

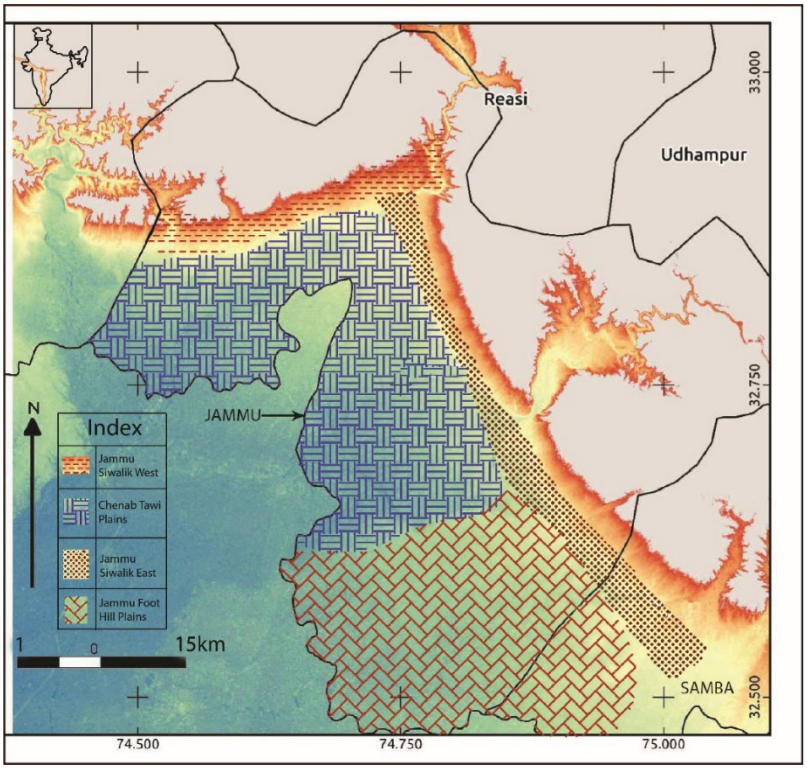


Figure III.2: Physiography of the Jammu district

The research area focuses on two zones: Chenab Tawi Plains and Jammu Foot Hill Plains.

III.3 Geology

Jammu district is divided into two main geological zones – Siwalik range and Southern outer plains (Qadir et al., 2019). The Siwaliks constitutes about 35% of the total area. The southern outer plains lie on the foothill of Siwaliks. This region is further divided into Kandi and Sirowal in north and south respectively (Fig. III.3), both of which form the current study area.

Kandi is the sub-montane region of the Himalayas, extending from Jammu and Kashmir to Assam and is equivalent of the Bhabhar belt. Hill torrents in this zone are dry for most of the time of the year and contain water only during freshets. Owing to this dryness of the streambeds, the tract is locally known as Kandi belt (Goyal & Rai, 2000). This belt constituting of the boulder conglomerate, pebbles, gravels, sandstone with considerable amount of clay and Siwalik rocks belongs to the Mio-Pliocene age (Qadir et al., 2019). With a general scarcity of springs or wells, the area is rich in Ponds (Kumar et al., 2004). The water table in the Kandi belt lie at a great depth (Centre ground water board [CGWB], 2016).

Located in the south and south-west of the Kandi belt is a stretch with gentle gradient lacking boulders and pebbles. Instead, the surface is constituted of finer material and the shallow groundwater depth supports good agriculture in the area. It is equivalent of the Tarai belt in other parts of Himalayas (Goyal & Rai, 2000). The southern Sirowal belt is made up of unconsolidated sediments in the form of terraces and coalescent alluvial fans formed because of the seasonal stream draining of Siwalik (Qadir et al., 2019). There are a large number of free-flowing artesian wells in the area owing to the shallow water table (CGWB, 2016).

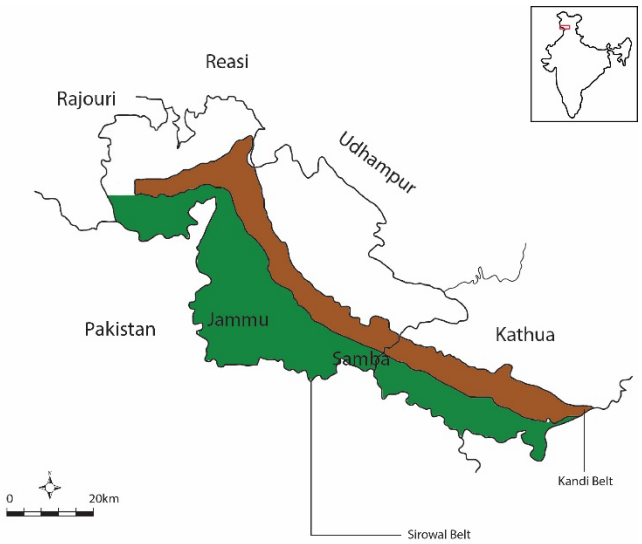


Figure III.3: Sirowal and Kandi areas in the Jammu district

The elevation of the Kandi belt is between 298-300 m to 491 m, and below this level is the area of Sirowal belt (Goyal and Rai, 2000; Kumar et al., 2004). This information is important as it will be helpful in assessing the spatial location of the sites.

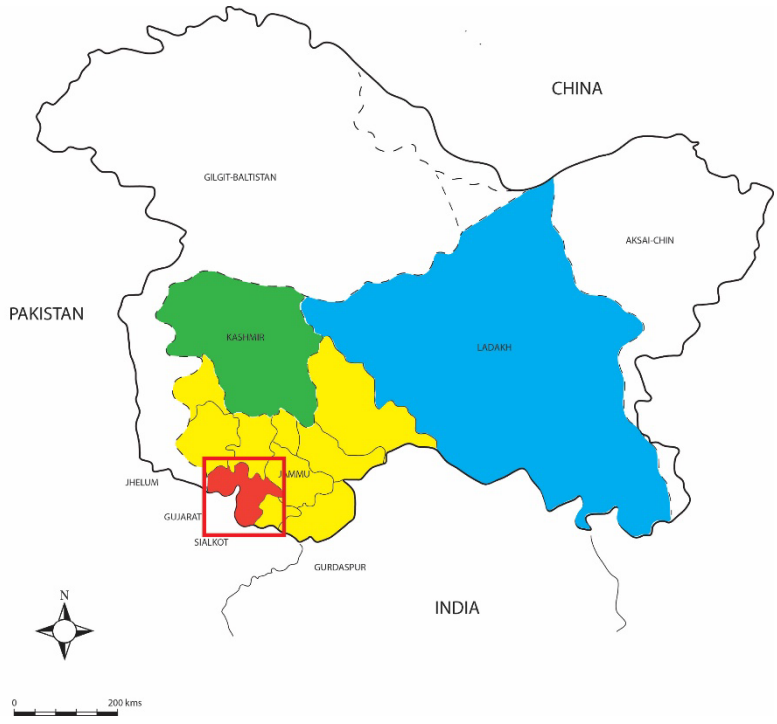
III.4 Drainage

There are four major perennial rivers flowing through the district – the Munawar Tawi, the Chenab, the Jammu Tawi, and the Basantar. The Munawar Tawi coming from Rajauri drains a small portion of the extreme west of the district and then flows to Pakistan (COI, 2011) (Fig. III.4). The river Chenab is formed of two principal feeders – the Chandra and the Bhaga. Both rise on the opposite sides of the Baralacha Pass (Himachal Pradesh), at an elevation of 16500 feet above the sea and merge at Tandi in Himachal Pradesh. From Tandi, pursuing a north-west course, the river reaches Kishtwar. Flowing through Reasi from Kishtwar, Chenab adopts a south westerly course to Akhnur. From Akhnur, the Chenab becomes navigable (Bates, 1873) and goes into the plains of Pakistan.

Major tributary of the river Chenab is the river Tawi. originating from Doda district (Kailash Kund glacier) draining the Jammu district and flows into Pakistan (COI, 2011). The river Basantar, an important tributary of the river Ravi originates near Kharai Dhat at an altitude of 1300 m above mean sea level and flows from the southern slope of Bani. From its source to Chak Chavalan, the river passes through deeply carved channel. It enters the flood plains near Samba and joins the Ravi in Pakistan (Sharma and Dutta, 2012).

Other than these rivers, the area is traversed by numerous ephemeral streams (*Khads and Nalas*) originating from the Siwalik hills (Goyal and Rai, 2000). Streams like Aik, Tarnah, Bein, Devak, are dry, wide and flat boulder bottomed drainage lines, intermittent in the Kandi belt and perennially draining the Sirowal belt (Kumar et al., 2004). They are dry in the Kandi tract but gain water through underground seepage and drain the Sirowal belt (CGWB, 2016). These Nalas and Khads do not serve any useful purpose but do vast damage in the shape of eroding land by water action. Irrigation by means of these Khads and Nalas is impracticable. Obtaining water for drinking water is therefore a problem in the Kandi areas. Water is scares in summer and people generally use tank water (Singh, 1981).

The Monsoonal rains have a major role to play in the region. Apart from rejuvenating the rivers, the monsoonal rainfall also replenishes the groundwater sources (CGWB, 2016), which have been the major source of domestic water till date. The aquifers in the Sirowal belt in fact, according to Census of India (2011), can yield about 150000 litres of water per hour. This is interesting to note in the background of the spatial location of the settlements as will be discussed in the further chapters.



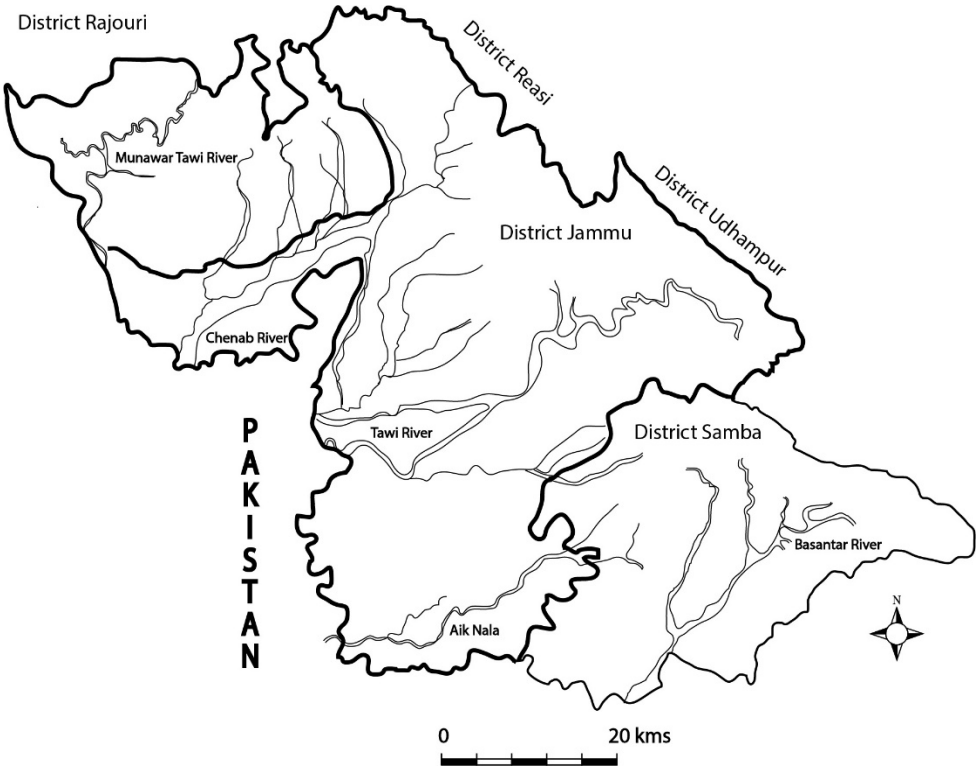


Figure III.4: District Jammu with its adjoining areas and river bodies

III.5 Climate

The district of Jammu has a sub-tropical climate with hot and dry conditions in summer and cold in winter. The temperature starts to fall rapidly from November till mid-February; with December to February constituting the winter season. The temperature starts to rise from March to June with March to third week of May being the summer season (Table III.1; Fig. III.5). The south-west monsoon is active till September. The months of October and November constitute the post monsoon season (Indian Meteorological Department [IMD], 2014).

Table III.1: Monthly mean maximum and minimum temperature of the Jammu District
Source – IMD, 2014

Month	Mean Maximum Temp	Mean Minimum Temp	Mean
January	18.9	7.8	13.35
February	21.6	9.8	15.7
March	25.9	13.9	19.9
April	32.0	18.9	25.45
May	37.2	23.3	30.25
June	38.7	26.0	32.25
July	34.0	25.3	29.65
August	33.1	24.8	28.95
September	33.1	23.1	28.1
October	31.2	18.1	24.65
November	26.6	13.0	19.8
December	21.2	9.0	15.1
Mean	29.5	17.8	

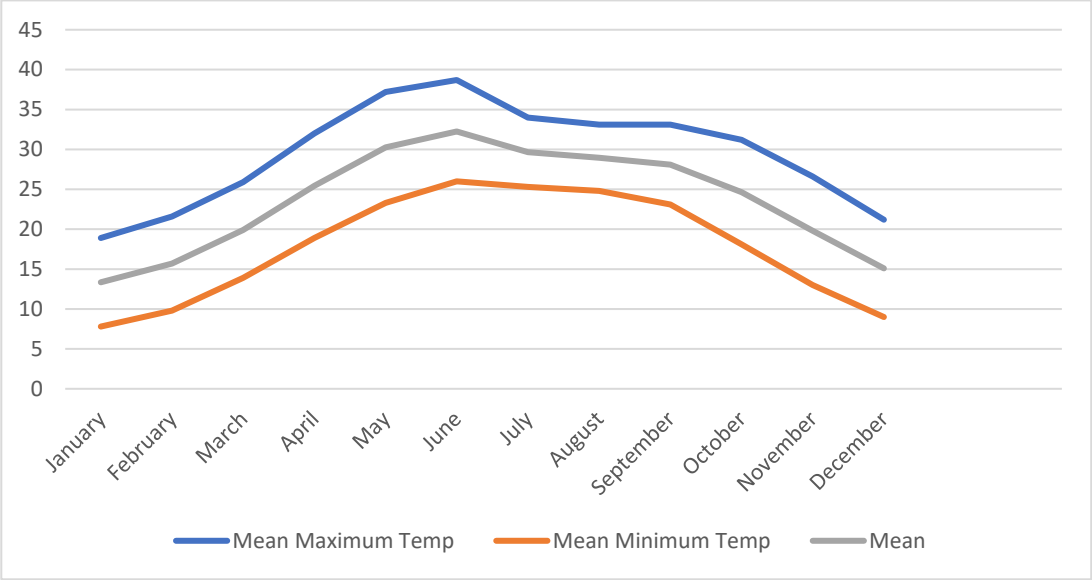


Figure III.5: Graph of the mean maximum and minimum temperature of Jammu district
Source: IMD, 2014

The mean monthly development in temperature of Jammu as shown above points towards one peak of maxima with the temperature shooting up in the months of April, May and June. In the month of May and June, the area experience hot and dry summer winds called *loo*. During the month of July till September, under the influence of south-west monsoon, the area experiences rainfall and a slight dip in the temperature, which further culminates in the onset of winters in the region. With the months of October and November, the nights become cool and the month of December, winters mark their way in Jammu till the month of February (Indian Meteorological Department [IMD], 2014).

The average annual rainfall in the district is 1204.8 mm. The annual rainfall in the district varies over a large range. The rainfall in the south-west monsoon season (June to September) is about 69% of annual normal rainfall, while the rainfall in pre monsoon month (March to May) is about 13% of the annual, July being the month with the highest rainfall with an average of 353.2 mm. The winter months (December to February) also contribute about 13% of the annual rainfall. On an average there are 50 rainy days (i.e., days with rainfall of 2.5 mm

or more) in a year in the district. This number varies from 32 at Ranbirsingh Pura to 61 at Akhnoor observatory (Table III.2; Fig. III.6) (IMD, 2014).

Table III.2: Climatological data from different stations of the Jammu district.
a: Normal rainfall in mm, b: Average number of rainy days (i.e., days with rainfall of 2.5 mm or more)

Station	No. of Years of Data		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Akhnoor (Observatory)	11	a	56.3	86.8	102.6	73.9	78.3	53	414.6	296.3	79.3	53.6	32.6	39.3	1366.6
		b	3.4	4.8	5.9	4.8	4	3.6	11.8	12.8	3.3	2.6	1	2.7	60.7
Jammu (Observatory)	40	a	51.3	64.6	65.3	37.3	26.4	72.2	335.7	359.7	134.4	32.1	13.8	39.9	1232.7
		b	3.3	3.7	4.4	2.7	2.5	4.3	11.3	12.9	5.3	1.7	1.1	2.2	55.4
Sri Ranbirsingh Pura	15	a	56.9	53	40.1	15.3	24.7	53.7	309.4	286.4	116.4	27.9	1.7	30.3	1015.8
		b	2.2	2.6	2.2	0.5	1.2	2.2	8.1	8.1	2.8	0.9	0.1	1.3	32.2
Jammu (District)		a	54.8	68.1	69.3	42.2	43.1	59.6	353.2	314.1	110	37.9	16	36.5	1204.8
		b	3	3.7	4.2	2.7	2.6	3.4	10.4	11.3	3.8	1.7	0.7	2.1	49.6
Mean		a	54.825	68.12	69.32	42.17	43.12	59.6	353.2	314.1	110	37.87	16.02	36.5	1204.9
		b	2.97	3.7	4.175	2.67	2.57	3.37	10.4	11.27	3.8	1.72	0.72	2.07	49.4

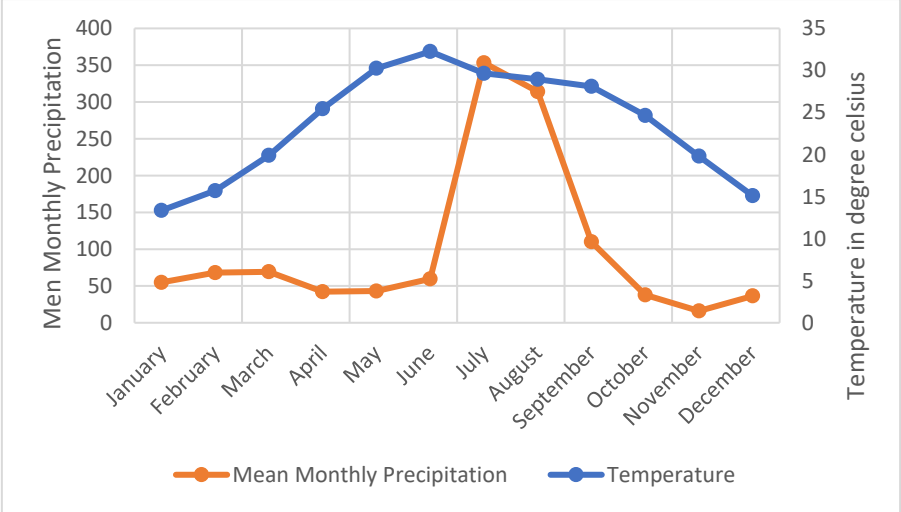


Figure III.6: Ombrothermic diagram of Jammu district

III.6 Soil

Two major types of soil are found in the district:

III.6.1 Lithosols

Generally found on the steep slopes in the foothills of Jammu district, the texture of the soil varies from gravely loam to gravely silty loam. The texture therefore allows the soil to have a good water holding capacity. The pH of the soil is nearly neutral in nature i.e.,7.1 to 7.8 (COI, 2011)

III.6.2 Alluvial Soils

Found in the plains of Jammu district, the soil has been divided into two groups – old alluvium and new alluvium. The old alluvial soils are calcareous and neutrals to alkaline in their reaction (pH 7.6- 8.4) and low to medium in organic carbon and nitrogen. The pH of the new alluvial soil ranges between 7.0-7.7 and is calcareous with low in organic carbon and nitrogen (COI, 2011).

The research area however shows further micro differentiation of the soil types (Personal communication Majid Farooq – scientific staff officer Department of Ecology, environment, and remote sensing Jammu). The Chenab Tawi Plain has a soil type ranging between Fine to Fine Loamy and the Jammu Foot hill

Plains show the variation in the texture of the soil ranging between fine to fine loamy and coarse loamy (Fig. III.7).

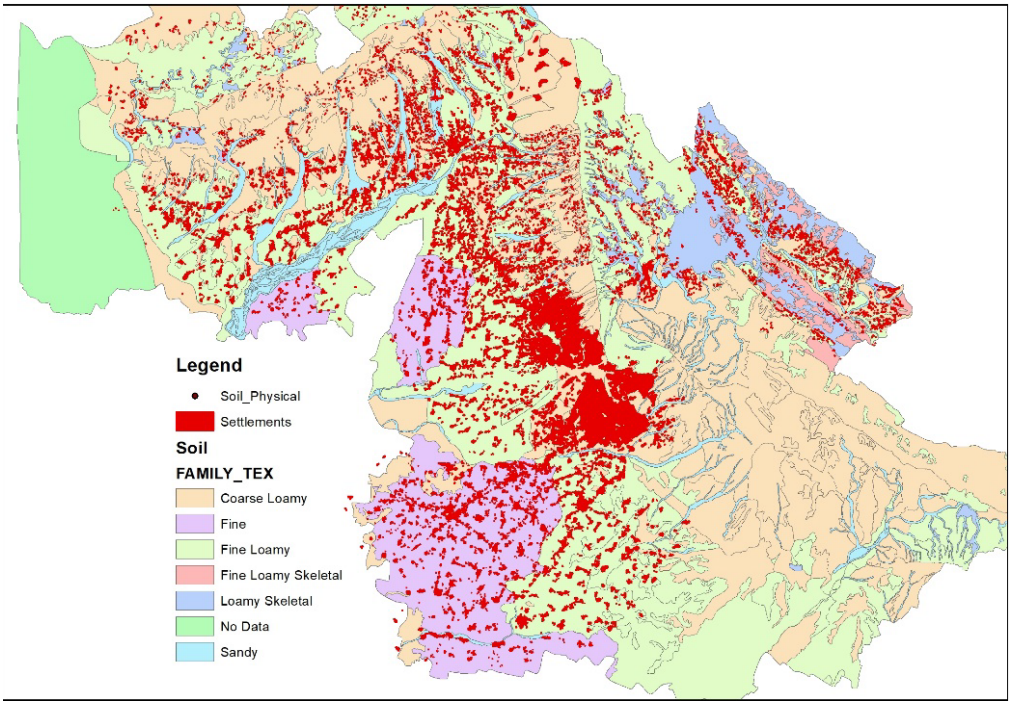


Figure III.7: District map of Jammu with different soil types
Map courtesy: Deptt. of Ecology, Environment and Remote Sensing Jammu

III.7 Land use Pattern

With a total geographic area of 3097000 hectares, the net sown area of the district is around 103366 hectares (Table III.3, Fig. III.8) (Digest of Statistics [DOS], 2015-16)

Table III.3: Land use pattern of the district of Jammu
DOS, 2015-16

S. No.	Category	Area in Hectares
1	Total Geographic Area	309700
2	Area under Forest	29793
3	Land put to non-agricultural use	34816
4	Barren and uncultivable land	34256
5	Permanent pastures and other grazing lands	4152
6	Land under Misc. tree crops	6349
7	Cultivable waste land	11844
8	Fallow land other than current fallows	808
9	Current fallows	5291
10	Net Sown Area	103366

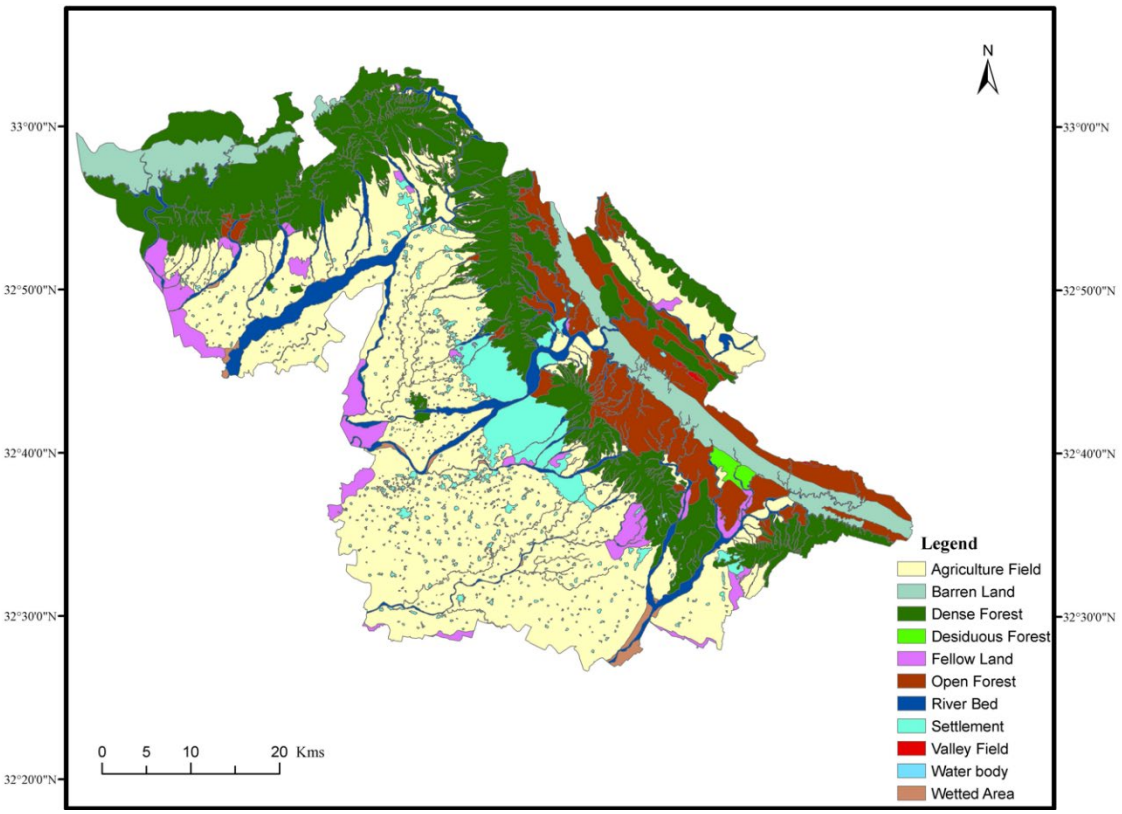


Figure III.8: Land use pattern of the study area. Map courtesy Kumar, 2012

Jammu district has both Kharif and Rabi cropping pattern (Table III.4). The main food crops of Rabi season are wheat and barley and those of Kharif season rice, maize and bajra. (COI, 2011). The Sirowal zone is the most fertile part and covers around 73% of the cropped area (CGWB, 2016). In the Kandi zones of Jammu and Akhnoor, dry crops like wheat and maize are cultivated. On the irrigated patches however, wheat and coarse paddy are grown. In the fertile zone of RS Pura, good quality rice is grown (Koul, 1978: introduction viii).

The assessment report of the Maidani tract[1] of Jammu tehsil area (1925), classified the soil of the area into two categories based on the availability of irrigation: Irrigated and Unirrigated. The former consists of *'Nahri, Chahi and Abi'* lands. *Nahri* irrigated by canals and the rest of the two irrigated by underground water sources. The unirrigated category was dependent on rainfall for cultivation and the *Kandi* land could be placed in this category (Sharma, 2018). The limitation of the agricultural production is visible in the Kandi area. The production of wheat, maize and rice was limited in Kandi areas, only bajra was found in excess, according to Wreford (1941). This is an interesting pattern and will be discussed in the forthcoming chapters.

[1] Maidani tract is the land bordered by river Chenab on the west, Sialkot and RS Pura on the south, Samba on the east and on in the north 'the high lying portions'.

Table III.4: Cropping pattern of the Jammu district
DOS, 2015-16

Crop	Area in Hectares
Rice/Paddy	79153
Bajra	5465
Maize	24213
Wheat	80204
Barley	392
Millet/Gram	2261
Pulses	205
Fruits and Vegetables	1386
Condiments and spices	110
Total Food crops	187942
Oil seeds	1461
Fodder crops	3418
Total Non-Food crops (including Oats)	4879
Total Area Sown	192821
Area Sown more than once	89455
Net Area Sown	103366

III.8 Natural Wealth

The only mineral of economic importance found in the district is bentonite clay and building stones (sandstone). The former is found as a thin band between Kulwalta and Ratanpura in the upper Siwalik zone. The latter is found in the Lower Siwalik zone. Apart from these, the Siwalik formation (middle and upper Siwaliks) of Jammu area contain vast deposits of clay in the form of white bands (COI, 2011).

However, the presence of minerals like Limestone, Graphite, Coal and Bauxite in the adjoining district of Rajouri and Iron ore, Magnesite, Copper ore, Barytes,

Lead and Zinc ore from Riasi district is notable (Government of India, 2005). Further presence of steatite deposit in Udhampur as documented by Law (2008) is interesting in the background of raw material acquisition during Harappan period as will be discussed further.

III.9 Flora and Fauna of the Research Area

III.9.1 Flora

In the broader aspect, the forests of Jammu division are represented by subtropical vegetation. Shrubs dominate the lower altitudes, in addition to broadleaved trees found either scattered or in patches. In higher altitudes towards the outer reaches of the ridges, trees of chir are found mixed with these shrubs. Further high in altitudes, chir trees predominate (COI, 2011).

The main flora of the area is elaborated in the following table (Table III.5):

Table III.5: Major flora of the Jammu division
Source: COI, 2011

Biological Name	**Common name**
Carissa spinarum	Conkerberry
Dodonea viscosa	Hopbush
Adhatoda vasica	Malabar nut
Colebrookia oppositifolia	Indian squirrel tail
Euphorbia royleana	Sullu spurge
Nerium odorum	Oleander
Woodfordia floribunda; Woodfordia fruiticosa	Fire flame bush
Wendlandia exserta	Roxbukan Pansara
Murraya koenigii	Curry leaf tree
Parthenium hysterophorus	Carrot grass
Xanthium strumarium	Rough cocklebur
Lantana camara	Wild sage
Ipomoea fistula	Pink morning glory
Nerium species	Oleander

Acacia species	Acacia
Albizia lebbeck	Lebbeck
Ficus species	Figs
Lannea coromandalica	Indian Ash tree
Dalbergia sissoo	North Indian Rosewood
Olea cuspidate	Wild Olive
Punica granatum	Pomegranate
Mallotus philippensis	Kamala tree
Berberis	Barberry
Mengi fera indica	Mango
Syzguim cumini	Malabar plum
Butea monosperma	Flame of the forest
Pinus roxburghii	Chir Pine
Rumex hastatus	Arrowleaf dock
Cymbopogon species	Lemongrass
Emblica officinalis	Indian Gooseberry

The adjoining districts of Jammu i.e., Udhampur, Doda, Kishtwar, Punch, Rajouri and Riasi all have forest cover above 1000 sq.km (Forest Survey of India, 2019). This is interesting to note in the background of the hypothesis that Jammu acted as a major timber procurement area owing to the water route via river Chenab, which is discussed in the following chapters.

III.9.2 Fauna

The following is the major fauna found in the division (Table III.6):

Table III.6: Major fauna found in the Jammu division
Source: COI, 2011

Biological Name	**Mammals**
Panthera pardus	Leopard
Canis aureus	Jackal

Biological Name	**Mammals**
Felis chaus	Junglecat
Vulpes bengalensis	Indian Fox
Ursus thibetanus laniger	Himalayan Black bear
	Rodents
Funambulus pennanti	Five striped Palm Squirrel
Hystrix indica	Indian Procupine
Lepus nigricollis	Common India Hare
Mus booduga	Indian Field Mouse
	Goat Group
Naemorhedus goral	Grey Himalayan Goral
	Deer Group
Muntiacus muntjak	Barking Deer
Axis porcinus	Hog Deer
	Pigs
Sus scrofa	Indian Wild Boar
	Primates
Presbytes entellus	Indian langur
Macaca mulatta	Monkey
	Land Birds
Gallus gallus	Red Jungle Fowl
Pavo cristatus	Common Peafowl
	Partridges and Quail Group
Francolinus francolinus	Black Partridges/Francolin
Francolinus pondicerianus	Grey Partridges/ Francolin
Alectoris graeca	Rock Patridges
Coturnix coturnix	Grey Quail
	Dove and Pigeon Group
Columba livia	Blue Rock Pigeon
Streptopelia chinesis	Spotted Dove

Streptopelia decaocto	Ring Dove
	Vultures
Gyps bengalensis	White Backed Bengal Vultures
	Other Birds
Psittacula krameri	Rose Ringed parakeet
Picus cholorophus	Small Yellownape woodpecker
Acridotheres tristis	Indian Mynah
Corvus macrorhynchos	Jungle Crow
Corvus splendens	House Crow
Eudynamys scolopaceus	Koel
Dinopium benghalense	Golden backed woodpecker
Saxicoloides fulicata	Indian Robin
Orthotomus sutorius	Tailor Bird
Terpsiphone paradise	Paradise Fly Catcher
	Reptiles
Naja naja	Indian Cobra
	Vipers
Bungarus caeruleus	Kraits
	Python
	Variety of Lizards

With this detailed description of geographical and environmental setting, and the current land use feature, the pattern of settlement distribution becomes comprehendible. The factors like spatial location, climate and drainage have a major role to play in the positioning of the sites and are a matter of discussion in the forthcoming chapters.